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## REPORT DOCUMENTATION PAGE

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BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)

Aesthetic Parameters of Lower Anterior Teeth

5. TYPE OF REPORT &amp; PERIOD COVERED

Submission of paper.

Feb 79 - Nov 79

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)

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8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS

US Army Institute of Dental Research  
Walter Reed Army Medical Center  
Washington, DC 2001210. PROGRAM ELEMENT, PROJECT, TASK  
AREA & WORK UNIT NUMBERS

NA

11. CONTROLLING OFFICE NAME AND ADDRESS

12. REPORT DATE

8 November 1979

13. NUMBER OF PAGES

18

14. MONITORING AGENCY NAME &amp; ADDRESS (if different from Controlling Office)

U.S. Army Medical Research & Development Command  
HQDA-IS  
Fort Detrick, MD 21701

15. SECURITY CLASS. (of this report)

UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING  
SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 15, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

aesthetic, lower anterior teeth, fixed prosthesis

20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The training in aesthetic parameters has been, for the most part, confined to the upper arch, yet there are studies which show that as age increases, more is seen of the lower anterior teeth. To design a lower anterior fixed prosthesis for good aesthetics, this paper determined that the following factors should be considered: degree of vertical and horizontal overlap; curve and height of the teeth; anterior placement of the incisal edge; and incisal contacts. Design factors which must be manipulated by the dentist is his prescription and techniques in fabrication are: overlap; incisal wear and facetting; and height and variety of contact area.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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AESTHETIC PARAMETERS OF LOWER ANTERIOR TEETH

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## AESTHETIC PARAMETERS OF LOWER ANTERIOR TEETH

The replacement of lost lower anterior teeth by a fixed prosthesis is one of the most demanding tasks in prosthodontics. Aside from the obvious difficulties attendant to any fixed prosthetic procedure there is the additional problem of gaining suitable aesthetics. Since lower anterior fixed prostheses are a relatively uncommon restoration in comparison to the ubiquity of the upper anterior fixed partial denture, the factors which are important and which should be controlled are not well understood.

A recent study by Cade<sup>1</sup> indicated that as the age of the patient increased, the lower teeth were displayed more and more during speaking. The lower anterior teeth were displayed at least as much as the maxillary teeth when the patient was speaking or resting. Vig and Brundo<sup>2</sup> considered the degree of visibility of the mandibular central versus the maxillary central and found that the mandibular incisor became more visible than the maxillary central in the 5th decade (40-49) of life. The inference that may be drawn from these studies is that the dentist should become conversant with the determining factors of the aesthetics of a lower bridge as much as upper bridges if the goals of aesthetics and naturalness are to be met.

### RESEARCH METHODOLOGY

One hundred and ten sets of diagnostic casts were selected from a pool of dental casts. These patients were from a military population with a high percentage of retired personnel and the



inference was made that the sample was of a mature population mainly in the second half of life (35-70 years old). The selection criteria were that the casts could be well articulated with the natural teeth only, that no more than one posterior tooth in any quadrant be missing and unreplaced, and no anterior teeth be missing.

These criteria were based on the desire to survey a selection of dentitions which exhibited a good degree of dental health and would express a normal range of age and health-induced changes.

#### EVALUATION PARAMETERS AND TECHNIQUE

A thirty-seven question form was designed which posed questions in separate areas: arrangement of lower anterior teeth as viewed from the anterior; curve of the incisal edge, condition and contour of the incisal edges in various teeth, relative height and placement of contact areas, diastemas and/or overlap of anteriors and rotation of cuspids.

Both authors evaluated all sets of casts and consensus decisions were made about each question. All results were coded and suitable cross-tabulations performed.

#### RESULTS

Maxillo mandibular relationships were classified at the molar and incisor areas. Table I indicates the relative percentage of occurrence of each category. Table II indicates the cross-tabulations comparing molar to incisor area positions. The tables confirm that, in general, the molar relationship is repeated at the

anterior except in C1 III molar relationships where C1 I incisor relationships may be seen frequently.

When viewed from the occlusal, the arrangement of the lower six anteriors was curved 69.5%, straight 17.5%, irregular 13.6%.

The contour of the lower anteriors was generally unrelated to shape of the maxillary arch (Table III). The only maxillary arch form that showed a distribution that was significantly different from the others was the square form. It can be inferred that a straight line arrangement of lower anteriors viewed from the occlusal is not a common occurrence (17.3%) except in cases where the maxillary arch is square (40%).

Occlusal contact of most or all lower anteriors with maxillary anteriors occurred 84.5% of the time. Contact of the incisors only occurred 2.7% and there was no contact 12.7%. The frequency of contact was not found to be related to the shape of the arch.

Seventy-five percent or more of the facial surface of the lower cuspids were visible from the anterior in 78% of all cases.

Horizontal and vertical overlap was measured in mm. (Table IV). The mean horizontal overlap is 3.507mm., the mean vertical 3.5. The distribution is leptokurtic.

Correlation coefficients were calculated for the sample overall and for only those sets of casts with C1 I molar relationships. There was no significant correlation between vertical and horizontal overlap ( $r^2_{\text{all classes}} = .01$ ,  $r^2_{\text{C1 I}} = .10$ ).

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The average thickness of the incisal edges of the lower anterior incisors was measured in mms. Table V. Average thickness is 1.8mm. and the distribution is also leptokurtic.

As viewed from the anterior, the incisal edges of the lower anteriors formed a convex curve 23.0% of the time, straight 56%, concave 21%. The tip of the cuspid was higher than the adjoining tooth 25.5%, lower 41.8% and the same height 32.7% of the time. The cuspid exhibited wear of the incisal edge 67.3% and the incisors 74.5%. Both cuspids and incisors appear worn 64% of the time. ( $\chi^2_{df1} = 50.63$   $p = .00000$ )

The cuspid-lateral contact areas were in the incisal third 27.6%, middle third 53.3%, gingival third 19.0% of the time. The lateral to central contact areas were 88.6% incisal, and 11.4% middle, central central contact 90.5 incisal, 9.5 middle third.

The contact area between cuspid and lateral was at the same height as the lateral-central contact area 29.5% of the time. It was lower 70.5% of the time.

Overlap occurred between laterals and centrals in 35% of the cases, between laterals and cuspids in 11%.

Diastemas occurred in 10% of the cases.

When the cuspid did not show signs of wear, the cuspid-lateral contact area was at the same height as the lateral-central contact only 8.8% of the time. When the cuspid was worn, the contacts were at the same height 39.4% ( $\chi^2_{df1} = 10.35474$   $p = .0013$ )

When the incisors were unworn, only 12% of the cuspid-lateral



contacts were at the same level as the lateral-central contacts. When the incisors were worn, 34% of the contacts were at the same level.

When cuspids were worn, more cuspid-lateral contacts appear in the incisal 1/3 (36%) than when the cuspids were not worn (8.8%). ( $\chi^2_{df2} = 16.15173$   $p = 0.0003$ ).

#### DISCUSSION

Determining the proper and/or desired aesthetic display for a lower anterior fixed prosthesis is not an intuitive skill. The training in aesthetic parameters has been, for the most part, confined to the upper arch yet previously cited studies<sup>1,2</sup> show that as age increases, more is seen of the lower anterior teeth.

In making decisions about the various parameters which control aesthetics, some of the previously mentioned results should be considered by both dentist and laboratory technicians. Placement of the lower anterior teeth can generally be made in accordance with the jaw relationship class as determined in the molar area except in C1 III molar relationships where a C1 I incisor relationship can be used. There is generally contact of all lower anteriors thus the contour of the incisors usually conforms to the curve of the upper anteriors.

The vertical position or height of the incisal edge of the lower anterior teeth can usually be determined by phonetic means. Visually, as viewed from the anterior, the incisal edges form a straight line from cuspid to cuspid only slightly more than 56%



of the time. The remainder form a convex (23%) or concave curve (21%).

There is no correlation between vertical and horizontal overlap. That is, although the average vertical and horizontal overlap are not statistically different, there is no correlation between the amount of vertical and horizontal overlap in any single occlusion.

The incisal edge in mature individuals is rounded or unworn in only 25% of the cases studied. Thus the incisal edge should have some wear facet or bevel. The average thickness is 1.8mm and the distribution is clustered around this point. In ceramo-metal restorations, this bevel provides an ideal opportunity for creative staining.

Although only 13.6% of the cases were classified as irregular in the arrangement of the lower anteriors, some degree of overlap occurred between central and lateral 35% of the time, and between lateral and cuspid 11% of the time. Diastemas occurred 10% of the time. Thus it is clear that straight and even lower anterior teeth, with unworn incisal edges, are the distinct exception. It is also of interest that the facial of lower cuspids is visible from the anterior to a great degree. (75% or more visible in 78% of all cases).

The placement of the contact areas is extremely critical to good aesthetics. The contact areas of teeth seem to shift as wear occurs. When the cuspid does not show wear, the cuspid-lateral

central area was at the same level as the lateral-central contact only 8.8% of the time but when the cuspid was worn, the contacts were at the same level 34.4% of the time ( $\chi^2_{df1} = 10.35474$   $p = .0013$ ). This same phenomenon occurs with the amount of incisor wear.

The cuspid lateral contact area is one of the keys to proper aesthetics in lower fixed prostheses. Proper placement of this contact allows for shaping and definition of the mesio-incisal angle of the lower cuspid and allows this tooth to be visually distinguished from the rest of the lower anteriors.

#### SUMMARY

Designing of a lower anterior fixed prosthesis for good aesthetics involves many factors. Factors which are, at least in part, functionally or phonetically determined, are, degree of vertical and horizontal overlap, curve and height of the teeth, anterior placement of the incisal edge, and incisal contacts. Design factors which must be appreciated and manipulated by the dentist in his prescription and the techniques in the fabrication are overlap, incisal wear and faceting, and height and variety of contact area.

It is these design factors which are crucial to the aesthetic success of a lower anterior fixed partial denture.

TABLE I

Class of Jaw Relation - %

	MOLAR AREA	INCISOR AREA
CL I	56.4	77.3
CL II	12.7	17.3
CL III	12.7	5.5
NOT CLASSIFIED DUE TO TOOTH MALPOSITION	18.2	



TABLE II

INCISOR  
RELATIONSHIP

	COUNT	I				ROW
	ROW PCT	I				TOTAL
	COL PCT	I				
	TOT PCT	I	CL 1. I	CL 2. I	CL 3. I	
Molar Relationship	1.	I	60	2	0	62
		I	96.8%	3.2%	0.0	56.4
		I	70.6	10.5	0.0	
		I	54.5	1.8	0.0	
	-I-	I	-I-	I	I	
	2.	I	2	12	0	14
		I	14.3	85.7	0.0	12.7
		I	2.4	63.2	0.0	
		I	1.8	10.9	0.0	
	-I-	I	-I-	I	I	
Mal-Posed Teeth-Class Not Determined	3.	I	8	0	6	14
		I	57.1	0.0	42.9	12.7
		I	9.4	0.0	100.0	
		I	7.3	0.0	5.5	
	-I-	I	-I-	I	I	
	4.	I	15	5	0	20
		I	75.0	25.0	0.0	18.2
		I	17.6	26.3	0.0	
		I	13.6	4.5	0.0	
	-I-	I	-I-	I	I	
COLUMN			85	19	6	110
TOTAL			77.3	17.3	5.5	100.0

TABLE III

Contour - As Viewed From Occlusal

Arch Form	Curved	Straight	Jumbled	Total % of Incidence
Square	40	40	20	4.5%
Oval	72.7	12.1	15.2	30%
Tapering	64.3	21.4	14.2	38.2%
Tapering Oval	76.7	13.3	10	27.3%
Total % of Incidence	69.5	17.5	13.6	

TABLE IV

		Horizontal Overlap %	Vertical Overlap %
from	0.0	7.3	12.7
to	1.0	1.8	.9
from	2.0	13.6	15.5
to	3.0	29.1	24.5
from	4.0	25.4	20.9
to	5.0	9.1	13.7
from	6.0	5.4	5.5
to	7.0	.9	3.6
from	8.0	4.5	1.8
to	9.0	1.8	.9
More Than		.9	.9



TABLE V  
THICKNESS OF INCISAL EDGE (MM)

		%
more than	.85	
including	1.2	.9
more than	1.5	33.1
including	1.8	21.1
more than	2.1	13.8
including	2.4	17.4
more than	2.4	8.3

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Thanks for technical and administrative support to Ms. Pat Scully of USA Regional Dental Activity, Walter Reed Army Medical Center, and Ms. Ailene Otterstedt of US Army Institute of Dental Research, Walter Reed Army Medical Center.

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